GZA
GeoEnvironmental, Inc.

Engineers and Scientists

Principals:
John P. Hartley,
District Office Manager
Michael A. Powers, P.E., L.S.P.
David R. Carchedi, Ph.D., P.E.
John J. Spirito, P.E., L.S.P.
Philip P. Virgadamo, P.E., L.S.P.

May 1, 1997
File No. 31030-C

Click Here to Return to Index

Mr. Dennis aRusso
Interdivisional Manager
R.I. Resource Recovery Corporation
65 Shun Pike
Johnston, Rhode Island 02919

Re: Central Landfill Operable Unit 2 RI/FS
Progress Report No. 26
Work Period: March 22, 1997 through April 30, 1997

140 Broadway
Providence
Rhode Island 02903
401-421-4140
FAX 401-751-8613

Dear Mr. aRusso:

This letter with attachments serves as the 26th progress report prepared by GZA GeoEnvironmental, Inc. (GZA) associated with activities completed to date on the Central Landfill Operable Unit 2 Remedial Investigation/Feasibility Study (OU2-RI/FS). This progress report has been prepared in accordance with the requirements of Section 37 of the Administrative Order by Consent, U.S. EPA Docket No. I-87-1016. We prepared this letter on behalf of the RIRRC in accordance with the terms and conditions of our July 1, 1996 Environmental Engineering Services Contract.

Please do not hesitate to call Ed at ext. 3133 with any questions or comments regarding this progress report; or contact via E-mail at gzari@ids.net (Edward Summerly).

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Edward A. Summerly, P.G.
Project Manager

A Subsidiary of GZA
GeoEnvironmental
Technologies, Inc.

EAS:rll

Attachments: Progress Report No. 26
Boring Logs (3)

cc: Mr. John Courcier/USEPA
Ms. Becky Cleaver/HNUS
Ms. Laurie Sclama/RIDEM

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PROGRESS MADE THIS REPORTING PERIOD

March 22, 1997 through April 30, 1997

DELIVERABLES AND CORRESPONDENCE THIS PERIOD

GZA has not submitted any correspondence to EPA and RIDEM on behalf of our client, the Rhode Island Resource Recovery Corporation (RIRRC), during this reporting period.

GZA has received the following correspondence from EPA and/or RIDEM regarding this project during this reporting period:

> RIDEM's approval of GZA's proposed revision to well decommissioning protocols, dated April 25, 1997.

On April 15, 1997, GZA Project Manager Edward Summerly and Project Engineer Stephen Kline participated in a conference call with EPA Project Manager John Courcier and EPA's oversight contractors Becky Cleaver and Michael Healey from HNUS. The purpose of the call was to discuss the impact of the loss of the middle sampling zone (119' to 134') in MW97-ML10 to the overall goals of the deep well installation project (Task 4A). After reviewing GZA's technical rationale the EPA concurred with our actions regarding the elimination of Zone B and at this time will not require the placement of an additional well to replace the lost zone. During this conference call we also discussed the decommissioning of the eight Hot Spot area wells and need to evaluate the EPA's OU2 pump test data in our future geohydrological assessments (i.e., OU2 Task 3A and the RI/FS reports).

On April 18, 1997, GZA's remedial investigation project staff and risk assessment project staff conducted a full day of meetings to coordinate and initiate the OU2 Human Health and Ecological Risk Assessment (RA). During this meeting GZA also addressed EPA and RIDEM's final comments to the draft Risk Assessment Work Plan. A Final OU2 Risk Assessment Work Plan document is forthcoming. The development of the RA Report will be conducted by a project team under the direction of Lisa Campe of GZA's Newton, Massachusetts office.

WORK ACCOMPLISHED THIS PERIOD

Multi-Media Sampling and Analytical Program/Task 1- Round 2

The OU2-Round 2 analytical data, validated by ECCI of Gorham, Maine, has been entered into our environmental monitoring database. These data are currently being consolidated with the Round 1 data, evaluated and utilized in the OU2 Human Health and Ecological Risk Assessment (RA). In addition, analytical data from the newly installed wells (see Task 4A) was received from Mitkem Corp (the CLP laboratory) on April 18, 1997. The

data was then sent to ECCI for Tier III data validation, data usability, and site chemist's evaluations on April 25, 1997. We anticipate receiving the validated data the week of May 19, 1997 in time to be evaluated as part of the RA.

Piezometric Measurement Program/Task 3A

GZA is beginning to evaluate the piezometric data collected during the 15-month monitoring program. This geohydrological data will be incorporated into the completion of the tasks described in OU2-RI and the Technical Memorandum entitled, Delineation of Groundwater Contamination Emanating from the OU1-Area, dated February 2, 1996. As mentioned above, GZA will incorporate some information from the EPA's pump test monitoring into our geohydrological assessment.

Deep Multi-level Well Installation (MW97-ML10)/Task 4A

An "as-built" survey of newly installed monitoring well locations (MW97-54, MW97-ML10A and MW97-ML10B) was performed on April 17, 1997. The three "as-built" boring logs are attached. In addition, after receiving the analytical data from the first round of sampling of these three wells, GZA began the second, and final round of groundwater sampling at these locations using full CLP protocols and QA/QC procedures as described in the SAP. The groundwater sampling, analytical and QA/QC protocols are summarized and attached in tabular form. We mobilized to the site on April 18, 1997 and purged a minimum of three standing well volumes from each of the wells. These newly installed wells were allowed to recover for four days prior to sampling MW97-54, MW97-ML10A, and MW97-ML10B by low flow protocols. It should be noted that due to extremely low recovery rates ML10B was not allowed to fully recover prior to sampling. We anticipate receiving the analytical data for this SDG by the week of May 19, 1997 with validation immediately following.

Residential Well Survey/Task 5A

GZA is currently finalizing the OU2/Task 5 Residential Well Survey Report. We anticipate submission of this report to EPA and RIDEM for review during the next reporting period. The results of the residential well sampling and analyses will be incorporated into the Risk Assessment.

UPCOMING EVENTS/ACTIVITIES

FIELD ACTIVITIES

We believe that the field investigation program for the Operable Unit 2 Remedial Investigation is complete pending additional data needs identified during the Risk Assessment.

REPORTS, CORRESPONDENCE AND MEETINGS

GZA is currently reviewing the revised schedule for the completion of the OU2 RI/FS process. We intend to issue a revised, detailed project schedule during the next reporting period.

KEY PERSONNEL

There have been no changes to the project staff.

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ANALYTICAL AND QA/QC SAMPLE SUMMARY
RECENT OU2 GROUNDWATER SAMPLING
Central Landfill - Johnston, Rhode Island

SAMPLE DELIVERY GROUPS	SAMPLING DATES	ANALYTICAL SAMPLES	TYPE OF ANALYSES [1]	QA/QC SAMPLES	COMMENTS
Groundwater Sampling (2-SGD)					
SDG #RW43	3/11 - 3/17/97	RW31/004	FULL CLP(2)	EBGW031197	Peristaltic pump blank
		RW43/007	WATER QUALITY PARAMETERS (3)	MW97-ML10A MS	Matrix Spike
		RW43/167		MW97-ML10A MSD	Matrix Spike Duplicate
		MW97-54		MW97-55	Blind Duplicate for MW97-54
		MW95-ML9C		TBGW031197	Trip Blank
		MW97-ML10A		TBGW031297	Trip Blank
		MW97-ML10B		TBGW031397	Trip Blank
				TBGW031497	Trip Blank
				TBGW031797	Trip Blank
SDG #MW54	4/23 - 4/24/97	MW97-54	FULL CLP(2)	EBGW042497	Peristaltic pump blank
		MW95-ML9C	WATER QUALITY PARAMETERS (3)	MW97-54 MS	Matrix Spike
		MW97-ML10A		MW97-54 MSD	Matrix Spike Duplicate
		MW97-ML10B		MW97-55	Blind Duplicate for MW97-ML10A
				TBGW042397	Trip Blank
				TBGW042497	Trip Blank

NOTES:

1) Analytical Method requirements are described in the November 6, 1995 "Sampling and Analysis Plan - Final Draft" (SAP) and "Quality Assurance Project Plan - Final Draft" (QAPP) for the Operable Unit 2 Remedial Investigation Central Landfill.
2) Full CLP includes TCL Volatiles and semi-volatiles with GC/MS library search, PCBs and pesticides, TAL metals including cyanide, and a standard CLP data package for each.
3) Water Quality Parameters for groundwater samples include the 15 analytes presented on Table 2, page 6 of the SAP.

GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND

GEOTECH/GEOHYDROLOGICAL CONSULTANTS

PROJECT
CENTRAL LANDFILL OU2/TASK 4A
JOHNSTON, RHODE ISLAND

REPORT OF BORING NO. MW97-54A
SHEET 1 OF 2
FILE NO. 31842
CHKD BY EAS

BORING CO. D.L. MAHER ENVIRONMENTAL
FOREMAN DENNIS DUCHNOWKSI
GZA ENGINEER STEPHEN KLINE

BORING LOCATION SEE EXPLORATION LOCATION PLAN
GROUND SURFACE ELEV. 293.5' DATUM NGVD
DATE START 1/20/97 DATE END 1/21/97

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 IN

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 LB HAMMER FALLING 24 IN.
CASING SIZE: 6" OTHER 5 7/8" PNEUMATIC AIR HAMMER

GROUNDWATER READINGS

DATE	TIME	WATER	CASING	STABILIZATION TIME
1/20/97	1630	7.76	34	0.5 HOURS
1/21/97		7.72	34	17 HOURS

DPTH (FT)	CASING BLOWS	SAMPLE NO	SAMPLE PEN/REC	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	R K
						Stratum descriptions determined from air hammer cuttings and drill rig response	1' TOPSOIL			1
5						Yellow/brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt	SAND AND GRAVEL FILL	GROUT		
							(COBBLES)			
							9'			2.
10						Olive/brown, fine to coarse SAND, some Silt, little fine Gravel	NATURAL GRAVELLY SAND (COBBLES)			
							15'			
15						Gray, fine to medium Gravel, little medium to coarse SAND, Silt	GRAY, GRAVELLY, SILTY SAND			
						Gray, fine Silty SAND, trace coarse Sand				
20							21'			
						Tan, fine to coarse SAND and fine Gravel	SAND WITH ORGANIC ODOR			
						Olive/green, fine to medium SAND, little Silt				
25							25'			
							26' BOULDER			
						Olive/brown, fine to coarse SAND, some Silt, little fine Gravel	SAND WITH ORGANIC ODOR			3.
30										
			G-1			Tan/orange, medium to fine SAND and fine GRAVEL, little Silt	32' STRATIFIED SAND AND GRAVEL			4.
35			G-2			Gray/brown, fine to coarse Gravel and medium to fine SAND (Gravel is blue/gray), little- Silt				
						Brown, fine to coarse SAND and fine to medium Gravel, little Silt				
40			G-3							

REMARKS:
1. No field screening was performed.
2. Estimated bottom of earthen dam.
3. Very easy drilling.
4. Making significant volumes of water, easy drilling drop 3 feet in 30 sec+.

GZA

BORING NO. MW97-54A

GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND

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PROJECT
CENTRAL LANDFILL OU2/TASK 4A
JOHNSTON, RHODE ISLAND

REPORT OF BORING NO. MW97-54A
SHEET 2 OF 2
FILE NO. 31842
CHKD BY EAS

DPTH	CASING BLOWS	SAMPLE NO	SAMPLE PEN/REC	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	RK
						Brown, fine to coarse SAND, little Silt, little fine Gravel	STRATIFIED SAND AND GRAVEL			5
						Material grades to coarse Sand and Gravel		GROUT		
45										6
						END OF EXPLORATION AT 47'±				7
50										
55										
60										
65										
70										
75										
80										

REMARKS:

5. Zone is producing a significant volume of water.
6. Neither rotten rock nor bedrock interface encountered by 47'+.
7. Casing separated 13'+ from bottom of borehole - could not retrieve - borehole was abandon by tremied in place bentonite/cement grout on 1/21/97.

NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES; TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED; FLUCTUATIONS OF GROUNDWATER TABLE MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

GZA

BORING NO. MW97-54A

GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND

GEOTECH/GEOHYDROLOGICAL CONSULTANTS

PROJECT
CENTRAL LANDFILL OU2/TASK 4A
JOHNSTON, RHODE ISLAND

REPORT OF BORING NO. MW97-54
SHEET 1 OF 2
FILE NO. 31842
CHKD BY EAS

BORING CO. D.L. MAHER ENVIRONMENTAL
FOREMAN DENNIS DUCHNOWKSI
GZA ENGINEER STEPHEN KLINE

BORING LOCATION SEE EXPLORATION LOCATION PLAN
GROUND SURFACE ELEV. 293.5' DATUM NGVD
DATE START 1/21/97 DATE END 1/22/97

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 IN

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 LB HAMMER FALLING 24 IN.

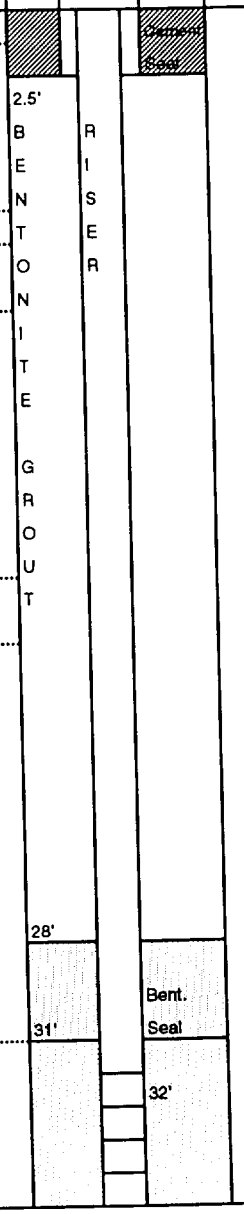
CASING SIZE: 6" OTHER 5 7/8" PNEUMATIC AIR HAMMER

GROUNDWATER READINGS

DATE	TIME	WATER	CASING	STABILIZATION TIME.
1/22/97	07:00	7.2'	50.5	OPEN BOREHOLE

DPTH (FT)	CASING BLOWS	SAMPLE NO	PEN/REC	DEPTH (FT)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION
						Stratum descriptions based on air hammer cuttings and drill rig response	1' TOPSOIL
							SAND AND GRAVEL FILL
5							6'
							7' BOULDER
							9'
10		G-1	8-10			Brown/gray, fine to coarse SAND, little Gravel, trace Silt	NATURAL SAND GRADING TO GRAVEL
15		G-2	15+			Brown, fine Gravel and medium to coarse Sand, trace Silt, trace Organics (roots and twigs)	FINE SAND & SILT
20		G-3	20+			Olive/gray, fine to coarse SAND, little fine Gravel, little+ Silt (organic odor)	SAND AND GRAVEL (COBBLES)
25		G-4	25+			Olive (silt color), medium to coarse SAND and fine Gravel, little- Silt	
30			31'			Brown/tan, fine to coarse SAND, trace Gravel	31' (COBBLES) STRATIFIED SAND AND GRAVEL
35		S-1	18/3	35-36.5	Pushed	Tan, fine to coarse SAND, little Gravel, trace Silt	

EQUIPMENT INSTALLED



FIELD TESTING	R K
	1
6.0	2
1.5	
1.1	3
ND	
ND	4

REMARKS:

1. Field screening performed with a Thermo Environmental Instruments Model 580 Organic Vapor Monitor (OVM) Photoionization Detector (PID) equipped with an 11.8 eV lamp. Readings are in parts per million (ppm). ND indicates less than 0.1 ppm in soil sample headspace.
2. Estimated bottom of earthen dam.
3. Making more water at 17'+.
4. Pushed 3" split spoon. Consolidated material. Very dense 1,000 lbs. pressure could only move 18" into material.

NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES; TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED; FLUCTUATIONS OF GROUNDWATER TABLE MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

GZA

BORING NO. MW97-54B

GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND

GEOTECH/GEOHYDROLOGICAL CONSULTANTS

PROJECT
CENTRAL LANDFILL OU2/TASK 4A
JOHNSTON, RHODE ISLAND

REPORT OF BORING NO. MW97-54
SHEET 2 OF 2
FILE NO. 31842
CHKD BY EAS

DPTH	CASING BLOWS	SAMPLE NO	SAMPLE PEN/REC	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	R K
							(More Gravelly)			
45		G-5		44-45		Cream/tan, medium to coarse SAND and fine Gravel, little Silt	(More Silty)	47'	ND	
		G-6		48		Tan, fine to coarse SAND, little Gravel, little Silt	48' ROTTEN ROCK	47.5' BENTONITE SEAL	ND	5
50		S-2	6/4	51-51.5	Pushed	Tan, fine to coarse SAND and sections of Granite cemented with Silts			ND	6 7
						END OF EXPLORATION AT 51.5'±				
55										
60										
65										
70										
75										
80										

REMARKS:

5. Air hammer on-soil holds more air after 48'.
6. Push 3" split spoon with 1,000 lbs. pressure only able to work 6"+ into strata.
7. A groundwater monitoring well constructed of 2" ID Sch. 40 PVC was installed with a 15' (10 slot) screen section to a depth of 47' and topped with 34.0' of solid riser pipe (2.0' above ground surface) on 1/22/97. The borehole annulus was backfilled with 4' of bentonite chips (51.5' to 47.5), 16.5' of filter sand around screen section (47.5' to 31'), a 3' bentonite seal (31' to 28'), and 28' of cement/bentonite ground (28' to 0'). The well is protected by a 4" ID x 5' locking, steel guard pipe set 2.5' below ground surface in a concrete seal.

NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES; TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED; FLUCTUATIONS OF GROUNDWATER TABLE MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

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BORING NO. MW97-54B

GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND

GEOTECH/GEOHYDROLOGICAL CONSULTANTS

PROJECT
CENTRAL LANDFILL OU2/TASK 4A
JOHNSTON, RHODE ISLAND

REPORT OF BORING NO. MW97-ML10
SHEET 1 OF 8
FILE NO. 31842
CHKD BY EAS

BORING CO. D.L. MAHER ENVIRONMENTAL
FOREMAN DENNIS DUCHNOWSKI
GZA ENGINEER STEPHEN KLINE

BORING LOCATION SEE EXPLORATION LOCATION PLAN
GROUND SURFACE ELEV. 293.5 DATUM NGVD
DATE START 1/8/97 DATE END 1/15/97

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 3" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 IN

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 LB HAMMER FALLING 24 IN.

CASING SIZE: 10"/6" OTHER 9 7/8 & 5 7/8" PNEUMATIC AIR HAMMER

GROUNDWATER READINGS

DATE	TIME	WATER	CASING	STABILIZATION TIME
1/8/97	13:00	5.0	10.0	0.5 HOURS
1/16/97	08:00	5.9	70.0	1 DAY

DPTH (FT)	CASING BLOWS	SAMPLE NO	PEN/REC	DEPTH (FT)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	RK
		S-1	24/16	0-2	8-9	Medium dense, dark brown, fine to medium	10" TOPSOIL	A B	55	1
					12-7	SAND, some Silt (roots and other organics)	SAND AND			2
						changing after 10" to tan, fine to coarse	GRAVEL			
						SAND, some fine to coarse Gravel	FILL	BENTONITE SEAL		
5							(Cobbles)	R R		3
		S-2	24/2	5-7	32-26	Very dense, olive/brown, fine to medium		I I	16	
		G-1		6	28-36	SAND and fine to medium Gravel, little+ Silt		S S		
						(saturated)	8'	E E		
								R R		
10										4
		S-3	24/8	10-12	3-6	Medium dense, olive/brown, fine to coarse	STRATIFIED		1.5	
					4-10	SAND, some fine to coarse Gravel, trace	SANDS	AQUA		
						Silt				
							(COBBLES)	GROUT		
15										
		S-4	24/20	15-17	21-23	Dense, olive/green, fine SAND, little- Silt			ND	
					18-19	interbedded with layers of coarse Sand,				
						some fine to medium Gravel				
										5
20										
		S-5	20/2	20-21.7	9-3	Dense, gray, fine SAND, trace Silt	21'		1.5	
					40-50/2"		GRAVEL			
							24.5'			
25							BOULDER			
										6
		S-6	24/7	27.5-29.5	2	Very loose, fine SAND, changing after 4"	27.5'		ND	7
					2-2	to gray, fine to coarse SAND, little blue and	SANDY GRAVEL			
30					3	orange, fine Gravel	30'			
							BOULDER			
							31'			
							COBBLES			
35							STRATIFIED SAND		1.6	8
		S-7	5/0	35-35.5	50+/5"	Very dense, gray, fine to coarse GRAVEL,	AND GRAVEL			
		G-2		35		trace fine to coarse Sand, trace Silt				

1. Field screening performed with a Thermo Environmental Instruments organic vapor monitor (OVM) Photoionization Detector (PID) equipped with an 11.8 eV lamp. Readings are in parts per million (ppm). ND indicates less than 0.1 ppm in soil sample headspace. Based on subsequent analytical testing it appears that the elevated headspace readings were potentially caused by water vapor and extreme cold.
2. Frost to 8 inches.
3. Sample is saturated. Poor recovery - took grab sample (G-1) from hammer may have been pushing a cobble. Sample has organic odor (like black licorish).
4. Approximately 1.5" rounded gravel in soil catch of sampler resulted in low sample recovery.
5. Split spoon refusal - very poor recovery - drill cuttings indicate fine to coarse gravel (quartz, mica granite) rounded edges, trace fine sand, trace silt.
6. Encountered granite boulder from 24.5'+ to 27.5'+ - Cyclone returned angular granite chips. Borehole making much more water.
7. Began with split spoon sample on 1/9/97 only 8' of water in casing (i.e., DTW=19.5') at 27.5ft - hydrostatic surface at 5'+.
8. Split spoon refusal at S-7 took grab sample G-2 at 35'+ from cyclone.

GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND

GEOTECH/GEOHYDROLOGICAL CONSULTANTS

PROJECT
CENTRAL LANDFILL OU2/TASK 4A
JOHNSTON, RHODE ISLAND

REPORT OF BORING NO. MW97-ML10
SHEET 2 OF 8
FILE NO. 31842
CHKD BY EAS

DPTH	MIN/FT	SAMPLE NO	SAMPLE PEN/REC	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	R K
							STRATIFIED SAND AND GRAVEL	BENSEALA / ARISER		
40									7.0	8
		G-5		40+		Light brown, fine GRAVEL and medium to coarse Sand, trace Silt				
45										
		G-6		45+		Yellowish brown fine to coarse SAND and Gravel, little (-) Silt		AQUA	ND	
							49'			
50	1						HIGHLY WEATHERED ROTTEN ROCK	GROUT		
	1	G-7		51+		White and black GRANITE Fragments Yellowish brown Silts			ND	
	2									
	2									
	2									
55	2						55'	T		9
	3	G-8		55+		White, GRANITE Fragments, cream colored Silts (more sand consistency)	GRANITE BEDROCK		ND	10
	2									
	2	G-9		58+						
	2									
60	2					10" ID steel casing installed to 60'			ND	11
	2	G-10		60+						
	2						63'			
	2					Fracture zone: (Red Silt 63'+ to 64'- borehole remains open)	FRACTURE ZONE			
	2						64'		ND	
65	2									
	2	G-11		65+		Light gray GRANITE (consistency of coarse Sand with cream/white Silts)		67'		
	2								ND	
	2									
	2					6" ID steel casing installed to 69.4'				
70	2	G-12		70+		Light gray GRANITE (slightly more Silts)		69'		
	2							70'		12
	2							FILTER SAND		13
	2									
	3									
75	3									
	3	G-13		75+		Light gray GRANITE (cream/white Silts)				
	3						77'		ND	
	3					Fracture zone (brown silts - easier drilling)	FRACTURE ZONE			
	1						78'	80'		

REMARKS:

8. Air hammer returns are very silty. Borehole making approximately 10+ gpm.
9. Rock increases in hardness at 55'.
10. On 1/9/97, spun casing to 58'. Advanced bit in front of casing 2'-borehole is not self supporting.
11. On 1/10/97, spun casing to 60' borehole making less water - silts are cream colored - competent rock drilled open borehole 10' and rock remains open-grouted in 6-inch casing.
12. During the grouting of the 6" casing, the 10" casing became stuck - could not be removed.
13. Grout allowed to set up over weekend before advancing 6-inch ID open borehole drilling on 1/13/97.

GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND

GEOTECH/GEOHYDROLOGICAL CONSULTANTS

PROJECT
CENTRAL LANDFILL OU2/TASK 4A
JOHNSTON, RHODE ISLAND

REPORT OF BORING NO. MW97-ML10
SHEET 3 OF 8
FILE NO. 31842
CHKD BY EAS

DPTH	MIN/FT	SAMPLE NO	SAMPLE PEN/REC	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	R K
81	1	G-14		80+		Light gray GRANITE (cream/white Silts)		B	ND	
	4									
	2					Fracture: brown Silts larger red granite	83'	83'		
	2					fragments (83'+)		Bent Steel		
85	2						GRAY GRANITE	R I S E R		
	1							85'		
	1									
	1						88'			
	4						FRACTURE ZONE	B E N S E A L A Q U A G R O U T		
90	4	G-15		90+		Fracture: brown Silts larger red granite	90'		ND	
	4					fragments (eratic hammer movement)	GRAY GRANITE			
	4						92' FRACTURE			
	1									
	1									
95	2					Granite: gray Silts (quartz sand fragments)				
	2									
	2									
	1					Fracture: (98'+) brown silts	98'			14
	1									
100	1						SOFT GRAY GRANITE			
	1									
	1									
	1									
	1						GRADUALLY HARDER GRAY GRANITE			
105	1	G-16		105+		Gray GRANITE (fine to coarse Sand			ND	
	2					fragment - gray Silts)				
	2									
	2									
	2									
110	2									
	2									
	2									
	2									
	2									
115	1	G-17		115+		Fracture zone: red/orange GRANITE	115'			
	2					fragments with brown Silts	FRACTURES			
	2									
	2						GRAY GRANITE			
	2									
120	1									

REMARKS:
14. Drill rig bucking-softer rock.

NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES; TRANSITIONS MAY BE GRADUAL.
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GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND

GEOTECH/GEOHYDROLOGICAL CONSULTANTS

PROJECT
CENTRAL LANDFILL OU2/TASK 4A
JOHNSTON, RHODE ISLAND

REPORT OF BORING NO. MW97-ML10
SHEET 4 OF 8
FILE NO. 31842
CHKD BY EAS

DPTH	MIN/FT.	SAMPLE NO	SAMPLE PEN/REC	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	R K
121	1					Fracture: Brown Silt red/orange granite	120' FRACTURES	B		
	2					fragments				
	1.5						122'			
	1.5						FRACTURE	R		
125	1.5	G-18		125+		Large granite fragments (more orange		I	ND	
	1.5					pink/gray Silts)	SOFTER STONE	S		
	1							B E		
	1						GRAY	E R		
	1							N		
130	1					Siltier discharge GRANITE is blue/black/dark		S		
	1					gray		E		
	0.5						132'	A		
	0.5					Fracture zone: Tan/yellow/black GRANITE	FRACTURES	L		
	1					Fragments, tan Silts (132' to 133')	133'			
135	1							A		
	1							Q		
	1.5	G-18					138'	U		
	2.0			138+		Black and white GRANITE with gray Silts	GRADUALLY	A	ND	
	8.0									
140	5.0						HARDER GRAY	G		15
	5.0							R		
	12.0						GRANITE	O		
	3.0							U		
	3.0							T		
145	3.0					Black and white GRANITE with green tint to				
	3.0					quartz - gray Silts				
	3.0									
	3.0									
	3.0									
150	3.0	G-20		150+		Black and white GRANITE - gray Silts			ND	
	3.0									
	3.0									
	0.5					Fracture: Large pieces in return with gray	152'			16
	5.0					Silts (152'+)				
155	5.0									
	5.0									
	5.0									
	5.0									
	5.0									
160	5.0									

REMARKS:

15. Granite became very hard hammer not progressing. Pulled pneumatic hammer from 142. Replace bit - continued drilling.
16. Drill head dropped 6"+ in approximately 30 seconds and then slowed again.

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REPORT OF BORING NO. MW97-ML10
SHEET 5 OF 8
FILE NO. 31842
CHKD BY EAS

DPTH	MIN/FT.	SAMPLE NO	SAMPLE PEN/REC	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	R K
161	5	G-21		160+		Black and white GRANITE - gray Silts		B	ND	
	3						162'			
	3					Small fractures? - drill rig jumped	163' FRACTURES			
	3						GRAY			
165	3						GRANITE	R		
	4							I		
	3							S		
	3					Fracture: (168'+)	168'	E	ND	17
	3							R		
170	3									
	3	G-22		170+		Black and white GRANITE fragments (fine				18
	4					to coarse SAND sized particles- slight green		B		
	5					tint to white fragments).		E		
	5							N		
175	5							S		
	5							E		
	5							A		
	5							L		
	5									
180	5							A		
	5	G-23		180+		White and gray GRANITE (still tint of green)		Q	1.1	19
	5					white/gray Silts trace black/yellow and orange		U		
	4					fragments		A		
	3									
185	3					Not making any more water slightly siltier	SOFTER ROCK	G		
	3							R		
	3							O		
	4							U		
	4							T		
190	5									
	5	G-24		190+		White and gray GRANITE (still tint of green)	HARDER AGAIN		1.1	
	5					white/gray Silts trace black/yellow and orange				
	5					fragments				
	5									
195	5									
	6									
	6									
	5									
	5									
200	5									

REMARKS:

17. Drill rig jumped at 168'+ larger rock fragments. Borehole appears to be making more water.
18. Driller has increased pressure on downward head (he says won't drag along the inside of borehole when questioned).
19. PID reading may be affected by moisture on the lamp, however, PID calibration check as acceptable.

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REPORT OF BORING NO. MW97-ML10
SHEET 6 OF 8
FILE NO. 31842
CHKD BY EAS

DPTH	MIN/FT.	SAMPLE NO	SAMPLE PEN/REC	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION / BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	R K
201	5	G-25		200+		White and gray GRANITE (still tint of green)	HARD	B	ND	
	5					white/gray Silts trace black/yellow and orange	GRAY			
	5					fragments (more silt and coarser fragments)	GRANITE			
	4							R		
205	4							I		
	4							S B		
	4							E E		
	4							R N		
	4							S		
210	4							E		
	4	G-26		210+		Mostly white GRANITE fragments, little		A	ND	
	5					black (water is even siltier fragments are		L		
	5					smaller)				
	7							A		20
215	3					More black flecks return of green tint to	SOFTER ROCK	Q		
	3					white		U		
	4							A		
	4									
	3							G		
220	3	G-27		220+		Larger/coarser granite fragments		R	ND	
	3					black and white GRANITE		O		
	3							U		
	3							T		
	3									
225	3									
	3									
	3									
	3									
	3									
230	3	G-28		230+		Larger/coarser granite fragments				
	3					with return to green tinit			ND	
	3									
	3									
	3									
235	3					Dropped from 234.5'+ to 235'+ very quickly	234.5'+			
	3					(no change in silt color)	FRACTURES			
	4						235'+			
	3									
	3									
240	3									

REMARKS:

20. On 1/14/97, air hammer ringing more loudly at 213'+ - bit is not cutting the bedrock - borehole making 2+gpm. Pulled tools to investigate. Bit is broken replaced and returned to drilling.

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REPORT OF BORING NO. MW97-ML10
SHEET 7 OF 8
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CHKD BY EAS

DPTH	MIN/FT.	SAMPLE NO	SAMPLE PEN/REC	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	RK
241	3	G-29		240+		Black and white grained GRANITE (slight		B	ND	
	2					gray/green tinit, fine to coarse SAND, sized	SOFTER COARSER			
	2					grains).	GRAINED			
	2						GRANITE	R		
								I		
245	2							S		
	2							E		B
	2							R		E
	3									N
	3									S
250	3									E ND
	4	G-30		250+		Black and white grained GRANITE				A
	3					More gray Silt, larger granite fragments	252'			
	2					(no green)	253'			L
	2						254' SOFT			
255	5						255' ZONE			A
	5									Q
	3									U
	3									A
	3						HARDER			
	3						ROCK			G
260	3									R ND
	3	G-31		260+		Black and white GRANITE				O
	3					More medium to coarse fragments, trace				U
	3					Gravel-more gray silt				T
	3									
265	3									
	3									
	3									
	4					Large fragment, more white silt, drill rig	268'			
	5					bucks and grinds, purple and green crystals				
270	2									
	2	G-32		270+		Green to gray GRANITE with little black and				ND
	2					trace purple large flat fragments)	272'			
	1						273' FRACTURES			
	2									
	2						275'	275'		
275	1					Fracture: (275'+)				Flint
	2									Shot
	2						SOFTER			Seal
	1									
280	2							279'		

REMARKS:

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SHEET 8 OF 8
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CHKD BY EAS

DPTH	MIN/FT	SAMPLE NO	PEN/REC	DEPTH (FT)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	STRATUM DESCRIPTION	EQUIPMENT INSTALLED	FIELD TESTING	RK
281	2	G-33		280+		Green/gray/white GRANITE fragments, gray	GRAY GRANITE	B		
	2					Silts				
	3							FILTER SAND		
	3									
285	3									
	3									
	2					FRACTURE (287'+)	287'			21
	2						FRACTURE ZONE			
	2									
290	2						290'			
	2	G-34		290+		Green black/gray GRANITE fragments, gray				
	3					Silts (fragments as large as fine GRAVEL)	GRADUALLY HARDER GRANITE			
	3									
	5									
295	7					White/gray trace black GRANITE				
	5									
	3									
	3									
	3					Green/gray/black GRANITE, fragments				22
300	3	G-35		300+		gray Silts				23
						END OF EXPLORATION AT 300'±				24
										25
										26
										27

REMARKS:

21. Air hammer returns medium to coarse GRAVEL fragments of broken rock.
22. Reached bottom 300' at 11:10 hours on 1/15/97 - developed borehole for 4 hours pumping and surging with 6-inch surge blocks. Borehole makes ±1.5 gpm water is clear with rust tint.
23. On 1/16/97 Colog, Inc. performed geophysical logging including: 3-arm borehole caliper, fluid temperature and resistivity, acoutic borehole televiewer, and heat-pulse flow meter logging.
24. Between 1/29 and 2/5/97, the borehole was packer tested using 16 10-foot long test intervals selected based on geophysical logging from 70 to 300 feet.
25. On 2/24/97 a short duration specific capacity test was performed while purging a volume of water equal to that lost to the formation during packer testing.
26. Based on the results of borehole geophysics, packer testing and discrete zone analytical sampling, two 2-inch ID Sch. 80 monitoring wells were installed to depths of 300' and 80' with a 20' and 10' foot 0.01" slotted screen, respectively. See equipment diagram for further installation details.
27. On 3/11/97, GZA installed QED "Well Wizard" dedicated bladder pump sampling systems in each monitoring well.

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